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ABSTRACT

The paper reviews research on the cognitive structures of gifted students. Theories of R. Sternberg and his triarchic model of intelligence are described. Sternberg asserts that three processes appear to account for insight: selective encoding, selective combination, and selective comparison. H. Gardner's perspective citing six types of intelligence is also discussed. An attempt at meta-analysis of these perspectives is offered, and it is concluded that gifted students process information more quickly, more expediently, and more insightfully than others, and that they are highly perceptive and insightful in their combining, comparing, and encoding of information. Domains in which gifted students can be distinguished from non-gifted students are identified. (CL)

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Cognitive Structures of the Gifted: Theoretical Perspectives, Factor Analysis, Triarchic Theories of Intelligence, and Insight Issues

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Running Head: Cognitive Structures

Abstract

The thinking processes and the cognitive structures of the gifted have been tangentially examined by various theorists of varying perspectives. Piagetians have offered one posture, i.e., formal operations as defined by hypothesis testing; information processing theorists, another. The Triarchic theory of Sternberg examines selective encoding, selective combination and selective comparison. These factors lead to insight and/or the ability to deal with novelty, while past factor analytic theorists have examined verbal comprehension, perceptual organization and freedom from distractibility. Gardner's recent work has cited no less than six separate forms of intelligence.

This paper examines these competing perspectives and attempts to provide a meta-analysis from which to view the cognitive structures of the gifted.

What differentiates the "gifted" from the normal? The aforementioned question has, of course, intrigued researchers, scientists, educators and psychologists for many years. In the past, the gifted have been seen as simply "more intelligent," "brighter," "quicker" or simply "sharper" than others. With the advent of intelligence testing, an objective measure was used to differentiate the "gifted" child from the average or normal child. The "gifted" child scored two standard deviations above the mean on an individually administered test of intelligence. Of course, there were other methodologies used for identification; e.g., teacher/parent nominations, achievement test scores, etc., but the Stanford-Binet and the WISC-R (Wechsler Intelligence Scale for Children-Revised) have both been the instruments of choice for final determination of giftedness. Thus, a most simplistic way of viewing giftedness is simply to accord those scoring above 130 on an IQ test as being "gifted."

As research with the Wechsler Intelligence Scale for Children-Revised was conducted, however, it appeared that there were other considerations in evaluation besides test scores. Through a statistical method known as factor analysis, data reduction was accomplished and three "factors" appeared. The first, "Verbal Comprehension," is based on the Verbal sub-tests of Information, Comprehension, Similarities and Vocabulary.

The second factor, "Perceptual Organization," stems from four of the Performance sub-tests; i.e., Block Design, Object Assembly, Picture Completion and Picture Arrangement.

The third factor, "Freedom from Distractibility," is based on the Arithmetic, Digit Span and Coding sub-tests. This final factor is linked to attention span, concentration and one's ability to avoid distractions.

The literature regarding factor analytic studies using the WISC-R has been extensively reviewed elsewhere (Shaughnessy and Jones, 1983) and more recently by Kroonenberg and Ter Berge (1985). However, two studies, focusing specifically on the gifted should be mentioned.

Karnes and Brown (1980) performed a factor analysis on a sample of 946 students (479 males, 467 females) ranging in age from 6 to 16. All of the subjects attained an IQ of 120 or above on an individually administered test of intelligence. A 10 x 10 intercorrelation matrix was generated for the sub-test scores across the total sample. A principal factor analysis (squared multiple correlations in the diagonals) with varimax rotation of 2, 3, and 4 factor solutions was performed. It was found that

> The two factor solution of the principal factor analysis paralleled the Verbal-Performance distinction set forth by Wechsler (1974)... The Verbal sub-tests (with the exception of Arithmetic) loaded highly on a factor identified as Verbal Comprehension factor (Kaufman, 1975)... The Performance sub-tests (with the exception of Coding) loaded highly on a second factor known as the Perceptual Organization factor (Karnes and Brown, 1980, p. 198).

An attempt was made by Willson, Reynolds and Gilberg (1983) to replicate the Karnes and Brown study. Willson et al used two separate samples. One was based on the National norm sample, the other from data utilized in research by Reschly (1978).

Perhaps the most salient "insight" into the cognitive structures of the gifted has come from Robert Sternberg of Yale University. Sternberg (1985) has recently proposed a triarchic model of intelligence based on a componential sub-theory, an experiential sub-theory and a contextual sub-theory. Several aspects of Sternberg's theorizing are germane to the cognitive structures of the gifted. First, Sternberg and Davidson (1982, 1983) have indicated that in terms of the gifted, "insight" appears to differentiate their functioning from that of average students. Three processes appear to account for "insight." These are: 1) selective encoding, 2) selective combination, and 3) selective comparison. Selective encoding refers to one's ability to discriminate, if you will, between essentials and non-essentials, between the wheat and the chaff and between the prof's jokes and material that will appear on a later test. The gifted appear to selectively attend and selectively process information, and avoid the computer aphorism of "garbage in, garbage out" syndrome.

Selective combination refers to the insightful ability of the gifted to "sift and synthesize" perhaps divergent or incongruous bits of information into a meaningful gestalt. The gifted can summarize and combine theories, ideas and hypotheses into a coherent paradigm or position. The "selective combination" may consist of themes, patterns, or threads, which when woven together, create an exemplary tapestry of intellectual insight. The late Silvano Arieti, author of Creativity: The Magic Synthesis, David McClelland of Harvard, and Keith Pritchard, now at the

University of Nebraska, are three superlative examples of this ability.

Finally, selective comparison involves the relating of new data to past knowledge. The midget standing on the shoulders of a giant can certainly see farther, but the well-read academician who can tie his/her work to the foundational work of others will secure his/her place in academic posterity.

These three processes are particularly germane in terms of "non-entrenched" or "novel" tasks (which the truly gifted handle with finesse) and in terms of "knowledge-acquisition," both constructs again, specified by Sternberg (1981, 1985).

Thus, the "gifted child" is better able to cope with divergent tasks and acquires knowledge more rapidly, both in the word realm (vocabulary) and in the world realm (general information and world knowledge). In addition, gifted superiority is linked to superior meta-componential skills (problem solving strategies, thinking about one's own thinking processes), the more "automatized" processes that are present in the gifted, i.e., the speed/rapidity with which the gifted "process" information, and finally the ability to apply one's expertise in specific domains. Of course, even among high IQ people there are differences in motivation, originality and task commitment. These perhaps extraneous variables (as well as "luck") may be operative in many situations.

Howard Gardner has yet another perspective on the "frames of mind" of gifted students. Gardner (1983) indicates that there are separate forms of intelligence. Citing no less than six

independent, autonomous "intelligences," Gardner has indicated that the concept of "IQ" is culturally relative. Some cultures favor linguistic intelligence, one's ability to deal with words and cope in the verbal realm. A separate intelligence may be musical--dealing with tone, pitch, rhythm and composition. The logical-mathematical domain is still another separate entity. Those who excel in dance, ballet, mime and acting may be demonstrating superior bodily kinesthetic intelligence.

Spatial intelligence, one's ability to deal with visualization and spatial relations, is another oft neglected realm of intelligence. Finally, the personal intelligences--inter-personal, one's ability to deal and cope with other people and intra-personal, one's knowledge of oneself--are the final components of this theory of Multiple Intelligences (MI).

Although Gardner does not directly address the thinking processes or cognitive structures of the gifted, he does examine exceptionalities (idiot savants, prodigies) and also lends support to his theory by drawing from recent research in neuropsychology.

In an endeavor to integrate the aforementioned theories and research, one must attempt a meta-analysis and/or synthesis. The work of David Feldman tries to go "Beyond Cognitive Universals". He has theorized that "there are four attributes that creative accomplishments of all varieties, including Piagetian universal achievements, seem to share in common." They are:

1. The initial consolidation of a newly reorganized structure or way of dealing with problematic situations is often accompanied by astonishment or surprise.

2. This solution, once achieved, often seems obvious, and one finds it hard to believe that it was possible to ever have thought differently.

3. As one moves toward a solution, there is often a strong--but difficult to describe--sense that the solution is "pulling" one toward it. This helps account for the fact that one often "recognizes" the solution when one achieves it, almost as if one had known it all along, but had not quite been able to express it.

4. There is, finally, the irreversibility of a solution once it is achieved. While other modes of dealing with a problem do not necessarily cease to exist, the new solution expands for all time the available means to organize experience. The solution will be taken as superior and applied to whole classes of relevant and often irrelevant problems (Feldman, 1980, p. 198).

These four attributes refer, of course, to the creative and do not specify any structural framework from which to view the creative child's structures d'ensemble. Attempting to specify a framework from which to view the gifted, prodigies and other highly talented individuals is hazardous, particularly due to the wide range of abilities at the end of the bell shaped curve. The four basic assumptions of cognitive and developmental theory (universal achievement, spontaneous acquisition, invariant sequences and transition rules) are essentially veridical for all children, even highly prodigious ones.

Posner and McLeod (1982) have indicated that structures represent enduring characteristics of the information processing

system. They correspond to specific domains of cognitive activity.

For the gifted it seems that: 1) They process information more quickly, more expediently and more insightfully than others. 2) They are highly perceptive and insightful in their combining, comparing and encoding of information. The specific factors causative relative to this seem to be many and diverse. A rich environment, early stimulation, and nurturing parents, coupled with succinct mentorship, may result in a gifted child, yet not a prodigy.

The above, although probably well known and common-sensical, has probably not as yet been formulated into a coherent, concise theoretical framework. As Piagetian theorists have not addressed giftedness an information processing perspective may be the only viable alternative.

Sternberg (1984) has indicated that perhaps between stage development is a fertile area for research into the cognitive structures of the gifted. "Differential efficacy" in a number of areas appears to discriminate between the gifted and non-gifted. These domains appear to be:

(1) Accelerated acquisition--both of knowledge and between stage acquisition of Piagetian constructs;

(2) Accelerated automatization--the gifted child learns to perform rote mechanical operations quicker and processes information at deeper levels with greater rapidity;

(3) Automatic activation--gifted thinkers more readily directly and indirectly activate componential processes (see

Sternberg, 1984) and access both indirect and direct feedback more readily than others;

(4) There seems to be a greater depth and propensity of emotive alignment. Thus, the young musician more readily chooses his instrument (violin), form of music (Renaissance concertos) and endears himself/herself to that chosen domain more rapidly and strongly than other less inclined peers. This metaphor can be used in any domain; e.g., history, medieval art, French literature;

(5) A secondary aspect of the above is intrinsic interest/inquisitiveness. This interest maintains the above emotive love for the subject area and sustains long term growth;

(6) Finally, componential chunking or meta-analysis (or both) provides greater potential for problem solving, investigation and solution production. This encompasses higher order abstraction, evaluation and synthesis.

Summary and Conclusion

Drawing upon a number of realms, the present paper has endeavored to investigate the cognitive structures of the gifted and his proposed a six realm domain for the understanding of cognitive processing propensities of the gifted. Tangential research relative to the model was cursorily reviewed, and it is hoped that further research will clarify relevant constructs so as to enhance gifted education and theorizing.

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